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मानक

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“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 14665-4 1 to 9 (2001): Electric Traction Lifts, Part 4: components, Section 1: Lifts Buffers, Section 2: Lift Guide Rails and Guide Shoes, Section 3: Lift Carframe, Car, Counterweight and Suspension, Section 4: Lift Safety Gears and Governors - Section 5 [ETD 25: Lift and Escalators]



“ज्ञान से एक नये भारत का निर्माण”

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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS 14665 (Part 4/Sec 1 to 9) : 2001

(Superseding IS 7759 : 1975,

IS 9803 : 1981, IS 9878 : 1981,

IS 10191 : 1982, IS 10448 : 1983,

IS 10913 : 1984, IS 11615 : 1986,

IS 11633 : 1986 and IS 11706 : 1986)

भारतीय मानक
विद्युत संकर्षण लिफ्टें
भाग 4 घटक

- अनुभाग 1 लिफ्ट बफर्स
अनुभाग 2 लिफ्ट गाईड रेलज़ एवं गाईड शूज़
अनुभाग 3 लिफ्ट कार फ्रेम, कार प्रतितोलक एवं निलंबन
अनुभाग 4 लिफ्ट सुरक्षा गियर्स एवं प्रतिनियंत्रक
अनुभाग 5 लिफ्ट रिटायरिंग कैम
अनुभाग 6 लिफ्ट डोर तथा लॉकिंग युक्तियाँ एवं संस्पर्श
अनुभाग 7 लिफ्ट मशीन एवं ब्रेक
अनुभाग 8 लिफ्ट हेतु तार रस्से
अनुभाग 9 लिफ्ट हेतु नियंत्रक एवं प्रचालक युक्तियाँ

Indian Standard

ELECTRIC TRACTION LIFTS

PART 4 COMPONENTS

- Section 1 Lift Buffers**
Section 2 Lift Guide Rails and Guide Shoes
Section 3 Lift Carframe, Car, Counterweight and Suspension
Section 4 Lift Safety Gears and Governors
Section 5 Lift Retiring Cam
Section 6 Lift Doors and Locking Devices and Contacts
Section 7 Lift Machines and Brakes
Section 8 Lift Wire Ropes
Section 9 Controller and Operating Devices for Lifts

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Price Group 11

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FOREWORD

This Indian Standard (Part 4/Sec 1 to 9) was adopted by the Bureau of Indian Standards, after the draft finalized by the Lifts and Escalators Sectional Committee had been approved by the Electrotechnical Division Council.

The necessity of lifts in multi-storeyed buildings has been so well recognized that no multi-storeyed building is planned without proper provision for lifts. The installation of lifts has been governed in states by different *Lifts Act* and *Rules* thereunder, which are intended to ensure safe installation and operation of the lifts. However, there is no uniformity in these rules regarding minimum standards of installation, which should be fulfilled for safe and reliable working of lifts and their components. This standard is intended to give necessary requirements for the components used in the lifts for safe installation, operation and maintenance of electric passenger, goods and service lifts.

This standard is one among the series of standards finalized by the Lifts and Escalators Sectional Committee as detailed below. This was done with a view to align Indian Standards with the latest developments in the field of lifts and escalators and also to align the standards with European Norms on Lifts and Escalators EN 81.

	<i>New IS Series</i>	<i>Superseding IS</i>
14665	Electric traction lifts:	
	Part 1 Outline dimensions of passenger, goods, service and hospital lifts	3534 : 1979 Outline dimensions of electric lifts (<i>first revision</i>)
	Part 2 Code of practice for installation, operation and maintenance,	
	Section 1 Passenger and goods lifts	1860 : 1980 Code of practice for installation, operation and maintenance of passenger and goods lifts (<i>first revision</i>)
	Section 2 Service lifts	6620 : 1972 Code of practice for installation, operation and maintenance of service lifts
	Part 3 Safety rules,	
	Section 1 Passenger and goods lifts	4666 : 1980 Electric passenger and goods lifts
	Section 2 Service lifts	6383 : 1971 Electric service lifts
	Part 4 Components,	
	Section 1 Lift buffers	9803 : 1981 Buffers for electric passenger and goods lifts

(*Continued on third cover*)

*Indian Standard***ELECTRIC TRACTION LIFTS****PART 4 COMPONENTS****Section 1 Lift Buffers****1 SCOPE**

This standard (Part 4/Sec 1) covers the requirements for buffers for use in passenger and goods lifts installations.

2 REFERENCE

The following Indian Standard contains provision which, through reference in this text, constitutes provision of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

<i>IS No.</i>	<i>Title</i>
7906 (Part 2) : 1975	Helical compression springs: Part 2 Cold coiled springs made from circular section wire and bar

3 TERMINOLOGY

Buffers are a device provided in the lift pit as a final emergency device to bring the descending lift car or counterweight to rest by absorbing the kinetic energy of motion should the car or counterweight pass the normal downward limit of travel. Buffers may also be fitted under the lift car or counterweight.

4 Types

4.1 Buffers shall be either energy accumulation type or energy dissipation type.

4.1.1 Energy Accumulation Type Buffer

Energy accumulation type buffer may be used only with lifts having a rated speed up to and including 1.5 m/s. For example, spring buffer.

4.1.2 Energy Dissipation Type Buffer

Energy dissipation type buffers may be used whatever may be the rated speed of the lift. For example, oil buffer.

5 STROKE OF CAR AND COUNTERWEIGHT BUFFERS**5.1 Energy Accumulation Type Buffers**

5.1.1 The minimum stroke shall be as follows:

<i>Car Speed</i> m/s	<i>Stroke</i> mm
Up to and including 0.5	40
0.6 to 0.75	65
0.76 to 1.0	100
1.1 to 1.25	160
1.26 to 1.5	250

5.1.2 Load Rating

Spring buffers for cars and counterweights shall be capable of supporting a minimum static load of twice the total weight of the loaded car or counterweights.

5.2 Energy Dissipation Type Buffers

5.2.1 The total possible stroke of the buffers shall be at least equal to the gravity stopping distance corresponding to 115 percent of the rated speed $0.067V^2$, the stroke being expressed in metres and rated speed (V) in metres per second.

5.2.2 With the rated load in the car, in the case of free fall, the average retardation during action of the buffers shall not exceed g_n where g_n is the standard acceleration of free fall in m/s^2 . Retardation of more than $2.5g_n$ shall not be longer than 0.04 s. The speed of impact on the buffers to be considered is equal to that for which the stroke of the buffer is calculated (see 5.2.1).

6 TEST PROCEDURE FOR TYPE TESTS**6.1 Energy Accumulation Type Buffers**

6.1.1 The springs used in spring type buffer shall comply with the requirements given in IS 7906 (Part 2). The test load for static load test shall be in accordance with IS 7906 (Part 2).

6.2 Oil Buffers

Oil buffer with oil porting as submitted shall be subjected to the following tests.

6.2.1 Retardation Test

The following drop tests shall be made for each buffer porting specified from a height such that the striking velocity of the falling weight is equal to 115 percent of the rated car speed for which the buffer is designed:

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- a) Three drop tests, with a total test mass equal to the manufacturer's rated maximum load for which the porting is designed.
- b) One drop test with a total test mass equal to the manufacturer's rated minimum load for which the porting is designed.

Following each drop test, the buffer shall be held in its fully compressed position for a period of 5 min; and shall then be allowed to return freely to its fully extended position and stand for 30 min to permit return of the oil to the reservoir and to permit the escape of any air entered in the oil.

On each of these tests the average retardation of the test mass, over the stroke of the buffer, shall not exceed 9.8 m/s^2 ; and any retardation peak having a duration of more than 0.04 s shall not exceed 24.5 m/s^2 .

6.2.2 Strength Test

Two drop tests shall be made as follows:

- a) One drop test shall be made with a total test mass equal to 120 percent of the manufacturer's rated maximum load, from a height such that the maximum velocity attained by the falling weight during the buffer compression shall be equal to 125 percent of the rated car speed for which the buffer is rated. In this test, the retardation shall be noted and shall not exceed the values specified in 6.2.1. Immediately following this test, the buffer shall be examined externally for visible deformation or injury. If no damage is apparent, the buffer shall be fully compressed at low speed and then released to determine if it will return freely to its extended position.
- b) After the buffer has been examined externally and has returned freely to its extended position, a second drop test shall be made, from the same height and with the same load as specified in 6.2.1. During this test the retardation shall not exceed the corresponding retardation developed in the test specified in 6.2.1 by more than 5 percent.

If for a given stroke of buffer having more than one porting, the construction of the buffer varies for the different portings, then a strength test similar to that specified above shall also be made for the porting having the range of minimum loads for which the porting is designed.

Following each drop test, the buffer shall be held in its fully compressed position for a period of 5 min and shall then be allowed to freely return to its fully extended position and stand for 30 min to permit return of the oil to the reservoir and to permit the escape of any air entered in the oil.

6.2.3 Oil Leakage Test

Test for oil leakage shall be made concurrently with the retardation tests specified in 6.2.1 and the drop test specified in 6.2.2 to determine the loss of oil during these tests. The oil level shall be noted after the buffer has returned to its fully extended position following each drop test, and after the time interval specified in 6.2.1 and 6.2.2.

The drop in oil level, as indicated by these measurements, shall show no loss of oil exceeding 5mm in level for each metre of buffer stroke. In no case shall the loss be such as to lower the oil level below the bottom of the plunger or below the highest metering orifice or port, whichever is the higher.

If the volume of oil above any metering orifice is small when the buffer is filled to its normal working level, the laboratory may make additional tests for oil leakage.

6.2.4 Plunger Return Test

On the drop tests specified in 6.2.1 and 6.2.2, the time required for buffer plunger to return to its fully extended position measure from the instant the test mass is raised clear of the buffer until the plunger has returned to its fully extended position, shall be noted. This time shall be not more than 90 s.

Should the plunger fail to return to its fully extended position, or the time required for it to return to its fully extended position exceed the time specified, the manufacturer shall either submit a duplicate buffer or install a new cylinder and piston, following which the plunger return test shall be repeated. Should the buffer again fail to meet the plunger return test requirements, it shall be rejected.

Buffer of the spring return type shall be tested for plunger return with a 9 kg test mass resting on top of the plunger during the test. The plunger shall be depressed 50 mm and, when released, the plunger while supporting the test mass shall return to its fully extended position within 30 s.

6.2.5 Tests for Lateral Movement

The following tests shall be made for lateral movement:

- a) *Spring return type buffers*

The lateral movement at the top of the fully extended plunger shall be accurately measured, the upper end of the plunger being moved by hand from its extreme right to its extreme left position. One-half of the total movement measured shall be considered as being the true lateral movement at the top of the plunger, and shall not exceed 5 mm per metre of buffer stroke.

b) *Gravity return type buffers*

A similar test for lateral movement shall be made, the measurement being taken at the lower end of the buffer cylinder when the buffer plunger is fully extended and braced to prevent lateral movement. One-half of the total movement measured shall not exceed 5 mm per metre of buffer stroke.

7 ACCEPTANCE TESTS FOR OIL BUFFERS

7.1 Oil Level Test

The level of oil shall be tested to determine that it is within the maximum and minimum allowable limits.

7.2 Plunger Return Tests

Buffers, when filled with oil, shall be tested for compliance with the following plunger return requirements:

- a) The plunger shall be fully compressed and when released, shall return to the fully extended position within 90 s, and
- b) A mass of 9 kg shall be placed on the plunger of spring return type buffers. The plunger with the mass resting on it shall be depressed 50 mm and then released. When released the plunger with the mass resting on it shall return to the fully extended position within 30 s.

7.3 Load and Speed Tests

Prior to making this test the load range and maximum speed given on the buffer nameplate

shall be checked to make sure that the correct buffer has been used. The car oil buffer shall be tested by running the car with its rated load on to the buffer at rated speed. The counterweight oil buffer shall be tested by running the counterweight on to its buffer at rated speed with no load in the car, provided, however, that for reduced-stroke buffers, this test shall be made at the reduced striking speed permitted therein.

In making these tests the normal terminal limit switches shall be made temporarily inoperative. The final terminal limit switches may remain operative but if used shall be temporarily relocated so as to open just before the buffer fully compresses.

NOTE — This test is made after the installation of the lift.

8 TEST CERTIFICATE

All buffers shall be tested at manufacturer's works. A copy of test report shall be submitted. In addition, oil buffers shall also be field tested as specified in 7.

9 MARKING

Each oil-type buffer shall be indelibly marked with the following information:

- a) Manufacturer's name or trade-mark,
- b) Buffer stroke,
- c) Maximum load, and
- d) Type and grade of oil to be used.

*Indian Standard***ELECTRIC TRACTION LIFTS****PART 4 COMPONENTS****Section 2 Lift Guide Rails and Guide Shoes****1 SCOPE**

This standard (Part 4/Sec 2) covers the requirements of car and counterweight guide rails, guide rail supports and fastenings and guide shoes for electric passenger and goods lifts.

2 TERMINOLOGY

For the purpose of this standard, the definitions given in 14665 (Part 2/Sec 1) 'Electric traction lifts: Part 4 Components, Section 1 Lift buffers' shall apply.

3 GENERAL PROVISIONS CONCERNING GUIDE RAILS

3.1 Guide rail shall be T section.

3.2 The strength of the guides (*see* Note), their attachments and joints shall be sufficient to withstand the forces imposed due to the operation of the safety gear and deflections due to uneven loading of the car. These deflections shall be limited to values that will not affect the normal operation of the lift.

NOTE — Buckling stresses in the guides.

3.3 The fixing of the guides to their brackets and to the building shall permit compensation, either automatically or by simple adjustment, of effects due to normal settling of the building or shrinkage of concrete.

A rotation of the attachments by which the guide could be released shall be prevented.

The buckling stress (σk in the guides during safety gear operation may be evaluated approximately by means of the following formulae:

Instantaneous safety gear
(except captive roller type)

$$\sigma k = \frac{25(P+Q)\omega}{A} \text{ (N/mm}^2\text{)}$$

Captive roller type safety gear

$$\sigma k = \frac{15(P+Q)\omega}{A} \text{ (N/mm}^2\text{)}$$

Progressive safety gear

$$\delta k = \sigma k = \frac{10+(P+Q)\omega}{A} \text{ (N/mm}^2\text{)}$$

σk shall not exceed:

140 N/mm for steel of 370 N/mm grade;

210 N/mm for steel of 520 N/mm grade;

(interpolate for intermediary values).

P = sum of the mass of the empty car and the masses of the portion of the travelling cables and any compensation devices, suspended from the car in kg;

Q = rated load in kg;

A = cross-sectional area of the guide in mm^2 ;

σk = buckling stress in the guides in N/mm^2 ;

Omega (ω) = buckling factor read in the tables as a function of Lambda (λ) (*see* Tables 1 and 2)

Lambda (λ) = $\frac{l_k}{i}$ = coefficient of slenderness;

l_k = maximum distance between guide brackets in mm; and

i = radius of gyration in mm.

4 GUIDING OF THE CAR AND COUNTERWEIGHT

4.1 The car and counterweight shall each be guided by at least two rigid steel guide rails.

4.2 For rated speeds exceeding 0.4 m/s, the car guides shall be made from drawn steel, or the rubbing surfaces shall be machined.

4.3 The requirements of **4.2** shall apply whatever the speed, when progressive safety gear is used.

Table 1 Buckling Factor ω as a Function of λ Coefficient of Slenderness for Steel of 370 N/mm² Grade
(Clause 3.3)

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1.04	1.04	1.04	1.05	1.05	1.06	1.06	1.07	1.07	1.08	20
30	1.08	1.09	1.09	1.10	1.10	1.11	1.11	1.12	1.13	1.13	30
40	1.14	1.15	1.15	1.16	1.16	1.17	1.18	1.19	1.19	1.20	40
50	1.21	1.22	1.23	1.23	1.24	1.25	1.26	1.27	1.28	1.29	50
60	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.39	1.40	60
70	1.41	1.42	1.44	1.45	1.46	1.48	1.49	1.50	1.52	1.53	70
80	1.55	1.56	1.58	1.59	1.61	1.62	1.64	1.66	1.68	1.69	80
90	1.71	1.73	1.74	1.76	1.78	1.80	1.82	1.84	1.86	1.88	90
100	1.90	1.92	1.94	1.96	1.98	2.00	2.02	2.05	2.07	2.09	100
110	2.11	2.14	2.16	2.18	2.21	2.23	2.27	2.31	2.35	2.39	110
120	2.43	2.47	2.51	2.55	2.60	2.64	2.68	2.72	2.77	2.81	120
130	2.85	2.90	2.94	2.99	3.03	3.08	3.12	3.17	3.22	3.26	130
140	3.31	3.36	3.41	3.45	3.50	3.55	3.60	3.65	3.70	3.75	140
150	3.80	3.85	3.90	3.95	4.00	4.06	4.11	4.16	4.22	4.27	150
160	4.32	4.38	4.43	4.49	4.54	4.60	4.65	4.71	4.77	4.82	160
170	4.88	4.94	5.00	5.05	5.11	5.17	5.23	5.29	5.35	5.41	170
180	5.47	5.53	5.59	5.66	5.72	5.78	5.84	5.91	5.97	6.03	180
190	6.10	6.16	6.23	6.29	6.36	6.42	6.49	6.55	6.62	6.69	190
200	6.75	6.82	6.89	6.96	7.03	7.10	7.17	7.24	7.31	7.38	200
210	7.45	7.52	7.59	7.66	7.73	7.81	7.88	7.95	8.03	8.10	210
220	8.17	8.25	8.32	8.40	8.47	8.55	8.63	8.70	8.78	8.86	220
230	8.93	9.01	9.09	9.17	9.25	9.33	9.41	9.49	9.57	9.65	230
240	9.73	9.81	9.89	9.97	10.05	10.14	10.22	10.30	10.39	10.47	240
250	10.55										

NOTE — Read values of λ vertically in tens and horizontally in units.

For example : $\lambda = 73 \omega = 1.45$

Table 2 Buckling Factor ω as a Function of λ Coefficient of Slenderness for Steel of 520 N/mm² Grade
(Clause 3.3)

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1.06	1.06	1.07	1.07	1.08	1.08	1.09	1.09	1.10	1.11	20
30	1.11	1.12	1.12	1.13	1.14	1.15	1.15	1.16	1.17	1.18	30
40	1.19	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	40
50	1.28	1.30	1.31	1.32	1.33	1.35	1.36	1.37	1.39	1.40	50
60	1.41	1.43	1.44	1.46	1.48	1.49	1.51	1.53	1.54	1.56	60
70	1.58	1.60	1.62	1.64	1.66	1.68	1.70	1.72	1.74	1.77	70
80	1.79	1.81	1.83	1.86	1.88	1.91	1.91	1.95	1.98	2.01	80
90	2.05	2.10	2.14	2.19	2.24	2.29	2.33	2.38	2.43	2.48	90
100	2.53	2.58	2.64	2.69	2.74	2.79	2.85	2.90	2.95	3.01	100
110	3.06	3.12	3.18	3.23	3.29	3.35	3.41	3.42	3.53	3.59	110
120	3.65	3.71	3.77	3.83	3.89	3.96	4.02	4.09	4.15	4.22	120
130	4.28	4.35	4.41	4.48	4.55	4.62	4.69	4.75	4.82	4.89	130
140	4.96	5.04	5.11	5.18	5.25	5.33	5.40	5.47	5.55	5.62	140
150	5.70	5.78	5.85	5.93	6.01	6.09	6.16	6.24	6.32	6.40	150
160	6.48	6.57	6.65	6.73	6.81	6.90	6.98	7.06	7.15	7.23	160
170	7.32	7.41	7.49	7.58	7.67	7.76	7.85	7.94	8.03	8.12	170
180	8.21	8.30	8.39	8.48	8.58	8.67	8.76	8.86	8.95	9.05	180
190	9.14	9.24	9.34	9.44	9.53	9.63	9.73	9.83	9.93	10.03	190
200	10.13	10.23	10.34	10.44	10.54	10.65	10.75	10.85	10.96	11.06	200
210	11.17	11.28	11.38	11.49	11.60	11.71	11.82	11.93	12.04	12.15	210
220	12.26	12.37	12.48	12.60	12.71	12.82	12.94	13.05	13.17	13.28	220
230	13.40	13.52	13.63	13.75	13.87	13.99	14.11	14.23	14.35	14.47	230
240	14.59	14.71	14.83	14.96	15.08	15.20	15.33	15.45	15.58	15.71	240
250	15.83										

5 GUIDE RAIL BRACKETS AND BUILDING SUPPORTS

5.1 Design and Strength of Brackets and Supports

The building constructions forming the supports for the guide rails, and the guide rail brackets,

shall be of such design as to safely withstand the application of the car or counterweight, when stopping the car and its rated load or the counterweight.

Where necessary, the building construction shall be reinforced to provide adequate support for the guide rails.

IS 14665 (Part 4/Sec 2) : 2001

NOTE — Lift-well walls of brick, terracotta and similar materials used in buildings of steel and concrete construction, are usually insufficient in strength to form by themselves adequate supports for the guide rails.

5.2 Bracket Fastenings

Guide rail brackets shall be secured to their supporting structure by means of bolts, rivets or by welding. Welding shall be done in accordance with relevant Indian standard.

6 GENERAL REQUIREMENTS FOR GUIDE SHOES

6.1 The car and counterweight of passenger and goods lift shall be provided with at least four guide shoes rigidly fixed to the carframe, with two guide shoes located above the lift car and two below the lift car. In the case of guide shoes for counterweight, two guide shoes shall be located adjacent or above the top of counterweight frame and two guide shoes shall be located adjacent or below the bottom of the counterweight frame. Guide shoes may be of sliding or roller type.

6.2 Guide shoes shall be made of cast iron, brass; or synthetic materials, such as nylon, fibre-base hylam, etc. Guide shoes may also be made of steel and cast iron, but having the liners of above material.

7 INFORMATION ON LIFT LAYOUTS

Elevator layout drawings shall, in addition to other data, indicate the following:

- a) The bracket spacing;
- b) The estimated maximum vertical forces on the guide rails on application of the safety device;
- c) In the case of goods lifts for motor vehicle, industrial truck loading or other heavy concentrated loading, horizontal forces on the guide rail faces during loading and unloading, and the estimated maximum horizontal forces in a post-wise direction on the guide rail faces on the application of the safety device; and
- d) The size and weight per metre of any rail reinforcements where provided.

*Indian Standard***ELECTRIC TRACTION LIFTS****PART 4 COMPONENTS****Section 3 Lift Carframe, Car, Counterweight and Suspension****1 SCOPE**

This standard (Part 4/Sec 3) covers the general requirement regarding construction of carframe, car, counterweights and the suspension of car and counterweights for electric passenger and goods lifts.

2 REFERENCES

The following Indian Standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
2365 : 1977	Steel wire suspension ropes for lifts, elevators and hoists (<i>first revision</i>)
14665 (Part 4/ Electric traction lifts: Part 4 Sec 8) : 2001	Components, Section 8 Lift wire ropes

3 TERMINOLOGY**3.1 Carframe**

A structural frame, generally composed of inter-connecting crosshead, upright and plank members, which supports the car platform and provides on each side of guide rails with upper and lower guide shoes attached to the frame.

3.2 Side Post Carframe

A carframe, which supports the car platform and car, wherein the plane of entrance to the car, is parallel to the plane of car rails.

3.3 Corner Post Carframe

A carframe, wherein, in addition to the support provided by carframe to car platform, additional support is provided by means of a truss connected above the crosshead or below the plank. Also the plane of entrance to the car is not parallel to the plane of the car rail.

3.4 Counterweight

A weight or series of weights to counter balance the weight of the lift car and part of the rated load.

4 CARFRAME**4.1 General Requirements**

4.1.1 Every passenger and goods lift suspended by wire ropes shall have a carframe.

4.1.2 Where the carframe is under slung or located entirely below the car platform, the vertical centre distance between the top and bottom guide shoes shall not be less than 40 percent of the distance between guide rails.

4.1.3 Where the platform is supported directly by the plank or by sound isolation frame, fixed to the plank, the vertical centre distance between guide shoes shall be not less than the distance between guide rails.

4.2 Materials

4.2.1 Materials used in the construction of carframe shall conform to the following.

4.2.1.1 Carframe shall be made of steel or any other metal.

4.2.1.2 Cast iron shall not be used for any parts subjected to tension, torsion or bending except guiding supports, guide shoes and anchorages for compensating chain and rope.

4.2.2 Steel used shall be rolled, formed or forged or cast.

4.2.3 Metals other than steel may be used in the construction of carframes, provided the metal used has the essential properties to meet all the requirements for the purpose in accordance with good engineering practices.

4.3 Carframe Connection

Connections between members of carframe shall be riveted, bolted or welded. Bolts and nuts when used through greater than 5° sloping flanges of structural members shall seat on taper washer.

4.4 Suspension Rope Hitch Plates

Suspension ropes attached to the car shall be attached to steel hitch plates or to structural steel shapes. If attachment is by bolts or rivets, the plates or shapes shall be secured to the underside or the webs of the carframe member

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with bolts, rivets or by welding, so located that tension in the suspension ropes does not develop direct tension in the bolts, rivets or weldment.

4.5 Carframe with Crosshead Sheaves

4.5.1 Sheaves Mounted on Carframe

Where a suspension rope sheave or sheaves are mounted on the carframe and the sheave shaft extends through the web of a carframe member, the reduction-area of the member shall not reduce the strength of the member. Where necessary, reinforcing plates shall be welded or riveted to the member to provide the required strength.

4.5.2 Multiplying Sheaves Mounted on Separate Sheave Shafts

Where multiplying sheaves mounted on separate sheave shaft are used, provision shall be made to take the compressive forces developed due to tension in the suspension ropes between the sheaves, on a strut or struts between sheave shaft supports or by providing additional compressive strength in the carframe or carframe member supporting the sheave shaft.

4.5.3 Sheave Mounted on Crosshead by Means of Single Threaded Rod

Where the sheave is mounted on crosshead by means of single threaded rod or specially designed member or members in tension, the following requirements shall apply.

4.5.3.1 The single rod member or members shall have a factor of safety of 50 percent higher than the factor of safety required for the suspension wire ropes, but in no case shall have a factor of safety less than 15.

4.5.3.2 The means of fastening the single threaded rod member or members of the carframe shall conform to 4.4.

4.6 Attachments to Carframe

Where side bracing and similar members are attached to the carframe, the reduction in area of the carframe due to attachments of the member shall not reduce the strength of the carframe below the limit for which it is designed.

5 CAR

5.1 Lift cars shall be enclosed on all sides by means of car body and doors or gates and such enclosures shall be at least 2 m clear in height. A roof solid or perforated, capable of supporting 2 persons, that is, 2 kg × 68 kg shall be provided. Perforations shall be sufficiently close in mesh and shall reject a ball of 25 mm diameter to provide reasonable protection against falling articles on any person travelling in the car. The car floor shall be of a flat non-slip surface or chequered surface.

5.2 Each lift car shall be fitted with a light, which shall be left burning during the whole time the lift is available for use.

5.3 Where car levelling devices are used, substantial aprons of sufficient depth shall be fitted to the car floor to ensure that no space more than the running clearances are permitted between the threshold and the landing while the car is being levelled to the floor.

5.4 Where the lift car has solid enclosure and doors, provisions shall be made for a fan and for adequate ventilation. To permit switching off the power supply to the lift without switching off the fan and light, a separate circuit with control in machine room shall be provided for fan and light. Ventilation openings shall be provided in the enclosure above 1.8 m level and below 0.3 m level. The total area of openings shall be not less than 0.035 m² for each square metre of area of the car floor divided suitably between the top and the bottom levels.

Any openings provided by a ventilating fan may be regarded as forming part of the ventilation area in that part of the car in which it is fitted.

5.5 The car enclosure and doors, including their tracks of every lift car shall withstand a thrust of 345 N applied normally at any point, excepting any vision panel, without permanent deformation.

5.6 A three-pin plug socket with switch for a hand lamp shall be fitted on top of the lift car for use by persons working thereon.

5.7 Lift car platforms shall be of framed construction and designed on the basis of rated loads evenly distributed. Platforms for goods cars shall be designed to suit the particular condition of loading. The minimum factor of safety shall be 5 for steel and 8 for timber.

5.8 Glass shall not be used in lift car except for the following purposes:

- a) As covers for certificates,
- b) For lighting fixtures,
- c) For appliances used in connection with the operation of car, and
- d) For vision panels and mirrors.

However, conditions may be relaxed in case of specially designed, well protected, fully transparent, laminated type glass for capsule type construction only.

5.9 Every lift car with solid enclosure and doors shall be provided with battery operated emergency light and emergency alarm. The lighting shall automatically come on in case of failure of normal lighting supply.

5.10 Emergency stopping device in car operating panel for automatically operated lifts with imperforated doors is prohibited. However, goods lifts in industrial premises where entrances are fitted with perforated doors in conformity with **15.2.1** of IS 14665 (Part 4/Sec 6) car operating panel shall be provided with emergency stopping device operated by a push button in the car and it shall be clearly marked in red.

5.11 An alarm button, yellow in colour, shall be provided on the car operating panel.

6 COUNTERWEIGHT

6.1 All counterweight sections (filler weights), metal or non-metal shall be carried in a single frame. Means shall be provided to retain counterweight sections in place and prevent displacement. In case of non-metallic filler weights, the counterweight sections shall be totally enclosed in a metallic covering. Where tie rods are used, minimum of two shall be provided, passing through all sections. The factor of safety of steel frame members and the tie rods shall not be less than 5.

6.2 If pulleys are fixed to the counterweight, they shall be provided with device to avoid:

- a) the suspension ropes, if slack, leaving the grooves; and
- b) the introduction of objects between ropes and grooves.

The devices shall be so constructed as not to hinder inspection or maintenance of the pulleys.

6.3 Counterweights shall withstand the effect of buffer impact.

6.4 At least four replaceable guide shoes with renewable lining or set of roller guides shall be provided, two at the top and two at the bottom of counterweight.

7 SUSPENSION

7.1 The minimum diameter of ropes for car and counterweight of passenger and goods lifts shall be 8 mm.

7.2 Chains shall not be used for suspension of a lift. For car or counterweight of any lift with traction drive, the number of independent suspension ropes shall not be less than four for 8 mm diameter ropes, and shall not be less than three for 10 mm and above diameter ropes.

7.3 Factor of Safety

The factor of safety of the suspension ropes shall not be less than as under:

Rope Speed M/S	Factor of Safety
Up to and including 2.0	10
Above 2.0 up to and including 3.0	11
Above 3.0 up to and including 7.0	12

In the case of traction drive, the factor of safety shall be based on static contract load plus the weight of the lift car and accessories. In case of drum type drives, the factor of safety shall be calculated with dynamic conditions.

For the purpose of this standard, the factor of safety is given by the following:

$$\text{Factor of Safety} = \frac{F \times n \times k}{w}$$

where

F = minimum breaking strength of one rope;

n = number of separate suspension ropes under load;

k = roping factor, that is, 1 for 1:1, 2 for 2:1 roping; and

w = maximum static load imposed on all car ropes with the car and its rated load at any position in the lift well, in the same units as F .

7.4 The car and counterweight ends of the suspension ropes shall be fastened by spliced return loops, clipped return loops or individual tapered babbitted sockets. Loops shall not bear directly on their fixings, but shall be lined with proper thimble eyes or equal protection. In all cases the fastenings shall be capable of sustaining a load not less than 80 percent of the minimum breaking strength of the suspension ropes.

7.5 The suspension ropes shall conform to IS 2365 and IS 14665 (Part 4/Sec 8).

8 SHEAVES AND PULLEYS

8.1 All driving sheaves fixed to and revolving with a shaft shall be fixed by means of sunk keys of sufficient strength and quality as required and shall conform to the relevant Indian Standards.

8.2 Sheaves and pulleys shall be of cast iron and free from cracks, sand holes and other injurious defects. They shall have machined rope grooves. The traction sheave shall be grooved to produce proper traction and shall be sufficiently thick to provide for future wear in the groove. The deflector sheave shall be grooved so as to provide a smooth bed for the rope. Deflector or secondary sheave assemblies where used shall be mounted in proper alignment with the traction sheave.

8.3 The grooving of a diverter sheave or pulley shall have a radius larger than the radius of the rope by not less than the amount shown in Table 1 and shall extend to at least over one-third of the circumference of the rope.

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Table 1 Flange and Diverter Sheave or Pulley Grooves

Rope Diameter	Minimum Difference Between Radius of Groove and Rope Radius
mm (1)	mm (2)
Up to and including 16	0.75
18 to 22	1.25
24 to 27	1.5
31 and above	2.5

8.4 Size of Sheaves and Pulleys

The diameter of sheave or pulley shall be not less than that obtained from the following:

<i>Class of Rope</i>	<i>Diameter of Sheave or Pulley</i>
Round Strand:	
6 × 19(12/6/1)	
6 × 19(12/6/1)plus 6 filler wires	$D (2.95 S + 37)$
8 × 19(12/6/1)plus 6 filler wires with a minimum	
8 × 19 (9/9/1) Seale	of 40 D

where

D = diameter of rope in cm, and

S = rope speed in m/s.

**AMENDMENT NO. 3 SEPTEMBER 2011
TO
IS 14665 (PART 4/SEC 3) : 2001 ELECTRIC
TRACTION LIFTS**

PART 4 COMPONENTS

Section 3 Lift Carframe, Car, Counterweight and Suspension

(Page 8, clause 5.3) — Substitute the following for the existing:

‘For all lifts, a substantial apron of minimum 750 mm depth shall be provided.’

(Page 9, clause 6.1) — Substitute the following for the existing:

‘**6.1** All counterweight sections (filler weights), metal or non-metal shall be carried in a single frame. Means shall be provided to retain counterweight sections in place and prevent displacement. In case of non-metallic filler weights, the counterweight sections shall be totally enclosed in a metallic covering. Alternatively, the non-metallic filler weights which are covered from sides by metallic coverings shall be properly supported at bottom of the lowermost filler weight and top of the topmost filler weight in the counterweight frame over the entire horizontal surface of the filler weights by metal plates of adequate thickness. Where tie rods are used minimum of two shall be provided, passing through all sections. The factor of safety of steel frame members and the tie rods shall not be less than 5.’

*Indian Standard***ELECTRIC TRACTION LIFTS****PART 4 COMPONENTS****Section 4 Lift Safety Gears and Governors****1 SCOPE**

This standard (Part 4/Sec 4) covers the requirements for safety gears and governors for electric passenger and goods lifts.

2 DEFINITIONS**2.1 Instantaneous Safety Gear**

A safety gear in which the full gripping action on the guides is almost immediate.

2.2 Progressive Safety Gear

A safety gear in which deceleration is effected by a braking action on the guides and for which special provisions are made so as to limit the forces on the car or counterweight to a permissible value.

2.3 Overspeed Governor

A device which, when the lift attains a predetermined speed causes the lift to stop and if necessary, causes the safety gear to be applied.

3 SAFETY GEAR**3.1 General Provisions**

3.1.1 Every lift car shall be provided with a safety gear located preferably at the lower part of the car and capable of operating only in the downward direction and capable of stopping a car carrying the rated load, at the tripping speed of the overspeed governor, even if the suspension devices break, by gripping the guides, and of holding the car there.

3.1.2 If accessible spaces do exist underneath the car or counterweight, the counterweight shall also be equipped with safety gear, operating only on a downward moving counterweight, capable of stopping it, at the tripping speed of the overspeed governor (or if the suspension devices break in the specific case of **3.3.1**) by gripping the guides, and of holding the counterweight there.

3.2 Conditions of Use for Different Types of Safety Gear

3.2.1 The following types of safety gears are recommended for use:

- a) Instantaneous type safety gear for car having rated speed not exceeding 1.0 m/s

and counterweights having a rated speed not exceeding 1.5 m/s.

- b) Progressive type safety gear for car having rated speed above 1.0 m/s.

3.2.2 If the car carries several safety gears, they shall all be of the progressive type.

3.3 Methods of Control

3.3.1 The safety gear of the car and counterweight shall each be tripped by its own overspeed governor.

3.3.2 The tripping of safety gears by devices, which operate electrically, hydraulically or pneumatically, is forbidden.

3.4 Safety gears of progressive type shall stop the lift car with contract load from governor tripping speed within the range of stopping distance given in Table 1.

Table 1 Stopping Distances for Progressive Type Safety Gears

(Clauses 3.4 and 5.5)

SI No.	Governor Tripping Speed, m/s	Stopping Distance mm	
		Max	Min
(1)	(2)	(3)	(4)
1	0.88	368	161
2	1.00	401	173
3	1.25	482	202
4	1.50	582	237
5	1.75	700	278
6	2.00	836	326
7	2.25	990	380
8	2.50	1162	441

3.4.1 The following formulae shall be used to determine the maximum and minimum stopping distance for progressive type safeties for car and counterweight for all intermediate speeds:

$$S_1 = 145 V^2 + 256$$

$$S_2 = 51 V^2 + 122$$

where

S_1 = maximum stopping distance in mm,

S_2 = minimum stopping distance in mm, and

V = governor tripping speed in m/s.

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3.5 Release

The release of the safety gear on the car (or the counterweight) shall only be possible by raising the car (or the counterweight). After its release, the safety gear shall be in a condition to operate normally. After the release of the safety gear it shall require the intervention of a competent person to return the lift to service.

3.6 Constructional Conditions

3.6.1 It is forbidden to use the jaws or safety blocks as guide shoes.

3.6.2 The safety gear operating devices shall preferably be located at the lower part of the car.

3.6.3 It shall be possible to seal adjustable components.

3.7 Inclination of the Car Floor in the Case of Safety Gear Operation

When the safety gear operates, the load (if any) being uniformly distributed, the floor of the car shall not incline more than 5 percent from its normal position.

3.8 Electrical Checking

When the car safety gear is engaged, an electrical safety device mounted on the car shall initiate the stopping of the motor before or at the moment of safety gear operation.

4 OVERSPEED GOVERNOR

4.1 Tripping of the Overspeed Governor for the car safety gear shall be adjusted as indicated below:

- a) Not less than 115 percent of rated speed;
- b) For rated speed of 1 m/s or less, maximum governor tripping speed shall be 140 percent of the rated speed or 0.88 m/s, whichever is higher;
- c) For the rated speed of above 1 m/s, the maximum governor tripping speed shall be 115 percent of the rated speed plus 0.25 m/s.

4.2 Choice of Tripping Speed

4.2.1 For lifts where the rated speed exceeds 1 m/s, it is recommended to choose a tripping speed as close as possible to the upper limit indicated in **4.1**.

4.2.2 For lifts with very heavy rated loads and low rated speeds, the overspeed governor shall be specially designed for this purpose.

It is recommended to choose a tripping speed as close as possible to the lower limit indicated in **4.1**.

4.3 The tripping speed of an overspeed governor for a counterweight safety gear shall be higher than that for the car safety gear, not, however, exceeding it by more than 10 percent.

4.4 The tensile force in the overspeed governor rope produced by the governor, when tripped, shall be at least the greater of the following two values:

- a) either 300 N, or
- b) twice the force necessary to engage the safety gear.

4.5 The direction of rotation, corresponding to the operation of the safety gear, shall be marked on the overspeed governor.

4.6 Overspeed Governor Ropes

4.6.1 The overspeed governor shall be driven by a very flexible wire rope.

4.6.2 The braking load of the rope shall be related by a safety factor of at least 8 to the tensile force produced in the rope of the overspeed governor when tripped.

4.6.3 The nominal rope diameter shall be at least 6 mm.

4.6.4 The ratio between the pitch circle diameter of the overspeed governor pulley and the nominal rope diameter shall be at least 30.

4.6.5 The rope shall be tensioned by a tensioning pulley.

4.6.6 During the engagement of the safety gear, the governor rope and its attachments shall remain intact, even in the case of a braking distance greater than normal.

4.6.7 The rope shall be easily detachable from the safety gear.

4.7 Response Time

The response time of the overspeed governor before tripping shall be sufficiently short not to permit a dangerous speed to be reached before the moment of safety gear operation.

4.8 Accessibility

The overspeed governor shall be completely accessible in all circumstances.

4.9 Possibility of Tripping the Overspeed Governor

During checks or tests, it shall be possible to operate the safety gear at a lower speed than that indicated in **4.1** by tripping the overspeed governor in some way.

4.10 The means of adjusting the overspeed governor shall be sealed after setting the tripping speed.

4.11 Speed Governor Overspeed Switch and Car Safety Gear Switch

4.11.1 A switch shall be provided on the speed governor and operated by the overspeed action of the governor for car speeds above 1.0 m/s and when used with counterweight safeties. Every

car safety shall be provided with a switch on top of the car and operated by the car safety mechanism. These switches shall, when operated, disconnect power supply from the driving machine motor and brake before or at the time of application of the safety.

4.11.2 Switches shall be positively opened. When operated by speed governor or car safety mechanism, they shall remain in the open position until manually reset after car safety mechanism has been returned to the off position.

4.11.3 The setting of the car speed governor overspeed switch shall conform to the following:

- a) For rated speed more than 1.0 m/s, the car speed governor overspeed switch shall open in the down direction of the lift at not more than 90 percent of the speed at which the governor is set to trip in the down direction.
- b) For rated speed more than 2.5 m/s, the car speed governor overspeed switch shall open in the down direction of the lift at not more than 95 percent of the speed at which the governor is set to trip in the down direction.
- c) The switch, when set as above, shall open in the up direction at not more than 100 percent of the speed at which the governor is set to trip in the down direction.

5 TESTS FOR GOVERNORS AND SAFETY GEARS

5.1 Governor Tripping Speeds

The tripping speed of the governor shall be measured by means of a tachometer and, if necessary, adjusted to comply with the requirements.

5.2 Governor Overspeed Switch

The operation of the governor overspeed switch, if provided, shall be checked.

5.3 Load Test for Safety Gear

Lift car safety gear shall be tested with 100 percent rated load in the lift car. For

testing of car safety gear, the load shall be centred on each quarter of the platform symmetrically with relation to the centre lines of the platform. Counterweight safety gear, where provided, shall be tested with no load in the car.

5.4 Speeds for Safety Gear

All the tests listed below shall be carried out under the supervision of qualified and experienced personnel.

5.4.1 The safety gear of any lift equipped with a direct current lift motor having a rated speed of less than 0.5 m/s and of any lift equipped with an ac lift motor shall be tested by running the car at its normal speed in the down direction and tripping the governor jaws by hand.

The stopping distance shall be based on the actual speed at which the safety gear operates. The governor tripping speed shall be tested by hand from an independent drive.

5.4.2 The safety gear of any other lift shall be tested by gradually increasing the lift motor speed (under power), until the governor causes application of the safety gear.

5.4.3 The car safety gear switch shall, when operated, disconnect power supply from the driving machine motor and brake before or at the time of application of the safety.

5.5 Progressive safety gears shall be tested for determining the stopping distance as per Table 1. It shall be determined by measuring the length of the marks made by the safety gear jaws on both sides of each car guide rail, deducting the length of the safety jaw or wedge and taking the average of four markings on the guide rail facings.

5.6 The overspeed switch on the governor shall be inoperative during the overspeed test. After operation of the safety gear, power supply to the lift motor shall be maintained, but only for sufficient time to demonstrate that the car (or counterweight) has come to rest.

Indian Standard

ELECTRIC TRACTION LIFTS

PART 4 COMPONENTS

Section 5 Lift Retiring Cam

1 SCOPE

This standard (Part 4/Sec 5) covers the requirements of retiring cam for electric passenger and goods lifts.

2 TERMINOLOGY

2.1 For the purpose of this standard, the following definitions in addition to that given in IS 14665 (Part 3/Sec 1) : 2001 'Electric traction lifts : Part 3 Safety rules, Section 1 Passenger and goods lifts' shall apply.

2.2 A device, which prevents the electromechanical lock at a landing from being unlocked while the lift, is bypassing that particular landing is called a retiring cam.

3 CONSTRUCTION

3.1 Retiring cam essentially consists of an electromagnet or an electric motor and a ramp or cam which actuates the electromechanical lock in order to unlock the landing doors. When the roller of landing door electromechanical lock is pressed by the retiring cam plates the door will be unlocked.

3.2 To protect against the risk of failing, it shall not be possible in normal operation to open a landing door (or any of the panels in case of multipanel door) unless the car has stopped or is on the point of stopping, in the unlocking zone of the door. The unlocking zone shall not extend more than 0.2 m above and below the landing level in case of manually operated doors. In the case, however, of power operated car and landing doors operating simultaneously, the unlocking zone may extend to a maximum of 0.35 m above and below the landing level.

3.3 In general, every passenger and goods lift having manually operated landing doors and more than two stops shall have a retiring cam to operate landing door electromechanical

locks. However, those electromechanical locks in which the landing doors cannot be unlocked from a landing even if the car is standing behind the landing except with the help of special key, do not require a retiring cam.

NOTE — Retiring cam may not be provided on power operated doors which shall be so designed that the electromechanical lock at a landing cannot be unlocked while the lift is bypassing that particular landing.

4 MATERIAL

Retiring cam and components used for assembly of retiring cam shall be of steel or other suitable materials.

5 OPERATION

Retiring cam used for actuating electromechanical lock shall exert a force for positive operation of electromechanical lock without damaging the mechanical lock lever.

It shall have a horizontal movement of at least 6 mm more than the average movement required to unlock the electromechanical lock.

The retiring cam shall be held away from the roller of electromechanical lock lever when the lift car is in motion under normal operation and during inspection.

Electromagnet or electric motor should be de-energized and the retiring cam shall drop by force of gravity or spring and actuate the electromechanical locking device when the lift car stops at a landing to unlock the landing door.

It shall be so located and adjusted in such a way that it operates the electromechanical lock when the lift car is within the unlocking zone.

In the event of car having more than one entrance, the landing door electromechanical lock shall be operated by independent retiring cams.

*Indian Standard***ELECTRIC TRACTION LIFTS****PART 4 COMPONENTS****Section 6 Lift Doors, Locking Devices and Contacts****1 SCOPE**

1.1 This standard (Part 4/Sec 6) covers the requirements of the following lift components used in passenger and goods lifts:

- Lift well door interlocks,
- Car door electrical contacts, and
- Car and landing doors for passenger and goods lifts.

1.2 This standard does not cover lift components rated higher than 600 V.

2 REFERENCES

The following Indian Standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
4218 (Part 2) : ISO metric screw threads: Part 1976	2 Diameter pitch combinations (<i>first revision</i>)
14665	Electric traction lifts:
(Part 2/Sec 1) : Code of practice for installation, 2000	operation and maintenance, Section 1 Passenger and goods lifts
(Part 4/Sec 1) : Components, Section 1 Lift 2001	buffers
(Part 4/Sec 4) : Components, Section 4 Lift 2001	safety gears and governors

3 TERMINOLOGY

3.1 For the purpose of this standard, the following definitions in addition to those given in 14665 (Part 2/Sec 1) shall apply.

3.2 Lift Well Door Interlock Device

A device having two related and interdependent functions which are:

- a) to prevent the operation of the lift driving machine by the normal operating devices

unless the landing door is locked in the closed position, and

- b) to prevent the opening of the landing door from the landing side unless the car is within the landing zone and is either stopped or being stopped.

3.3 Car Door Electrical Contacts

An electric device, the function of which is to prevent operation of the driving machine by the normal operating device unless the car door is in the closed position.

3.4 Car Door

A single or multipanel or collapsible door that protects the car entrance.

3.5 Door, Manually Operated

A door which is opened and closed by hand alone.

3.6 Door, Power Operated

A door, which is opened and closed by motive power other than by hand.

3.7 Landing Door

A single or multipanel or collapsible door that protects the landing entrance.

4 GENERAL REQUIREMENTS

All parts shall be made of materials suitable for the purpose and shall be properly and accurately assembled to assure correct functioning.

5 LIFT DOOR INTERLOCKS AND CONTACTS**5.1 Operation**

5.1.1 Lift well door interlocks shall conform to the following requirements:

- a) Interlock contacts shall be positively opened by the locking member or by a member connected to and mechanically operated by the locking member. The contacts shall be maintained in the open position by the action of gravity or by a restrained compression spring, or by both, or by means of the opening member.

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- b) The interlock shall hold the door in the closed position by means of gravity or by a restrained compression spring, or by both, by means of a positive linkage.
- c) The interlock shall lock the door in the closed position before the interlock contacts close.

5.1.2 It shall not be possible to open the landing door from the landing side until the lift car is within that particular landing zone. Provision shall be made for opening of the door in case of emergency by means of a special key.

5.1.3 It shall not be possible for the car to be started or kept in motion unless all the landing doors are closed and locked except when the car is coming to a stop at a landing within the levelling zone.

5.1.4 The electrical and mechanical parts of all locking devices shall be of substantial design and construction. The removal of any inspection cover or covers shall not affect the operation of a device. All locking devices shall be fixed securely to the enclosure by suitable means.

5.1.5 The locking devices for landing doors shall be so designed that the lock contact is not closed until the door is closed, and the circuit shall not be completed until the leading edge of the door is within 50 mm of the nearest face of the door-jamb or when the leading edges of the centre opening door are within 50 mm contact of each other.

5.1.6 Any spring used in the locking device shall be in compression and properly supported. The failure of a spring shall not render the lock unsafe.

5.1.7 Contact shall be of solid type pivoted, hinged or sliding and of sturdy construction.

5.1.8 Provision shall be made on lifts operated from the car and landings to prevent the opening of any landing door when the car is passing that zone in response to a call from another landing.

5.1.9 The conduit carrying the conductor to the lock or contact boxes shall be fixed securely to the boxes and shall maintain electrical and mechanical continuity.

5.1.10 The levers operating the mechanical part of the locking device shall be protected from interference from the landing side of the lift enclosure.

5.1.11 Locking devices used with multiple panel doors shall lock all panels of the doors or only one panel provided that the interconnecting mechanism of door panels is so arranged that the locking of one will prevent the movement of all panels, not withstanding the breakage of chain or rope used for interlocking the panels.

When a door locking device is used on one panel of vertically biparting landing door, reliance shall not be placed on gravity to keep the other panel closed.

5.2 Car door electrical contacts shall conform to the following requirements.

5.2.1 These contacts shall be positively opened by a lever or other device attached to and operated by the car door.

5.2.2 They shall be maintained in the open position by the action of gravity or by a restrained compression spring, or by both, or by positive mechanical means.

5.2.3 Every car door shall be equipped with an electric contact which shall prevent the movement of the car and the circuit shall not be completed until the leading edge of the door is within 50 mm of the nearest face of the door-jamb or when the leading edges of the centre opening doors are within 50 mm of contact of each other. The contact shall be opened positively independently of gravity. The electric contact shall be situated or protected so as to be reasonably inaccessible from inside the car.

5.2.4 In case of multi panel doors, every panel shall have an electrical contact [see IS 14665 (Part 4/Sec 1)].

5.2.5 The contact may be provided on only one panel (rapid panel in case of telescopic doors) if the interconnecting mechanism of door panels is so arranged that the movement of any panel will cause the movement of the panel on which the safety contact is fixed leading to opening of the contact notwithstanding the breakage of chain or rope used (if any) for interconnecting panels.

6 ASSEMBLY

A lift door locking device or contacts shall be so formed and assembled that it will have the strength and rigidity necessary to resist the abuses to which it may be subjected without increasing its accident or fire hazard due to total or partial collapse with resulting interference with the functioning of parts, loosening or displacements of parts, or reduction of spacing.

7 WIRING TERMINALS

7.1 Terminal parts by which field-wiring connections are made shall ensure thoroughly good connections even under hard usage. The parts to which wiring connections are made may consist of clamps or wire-binding screws with cupped washers, terminal plates having upturned lugs, or the equivalent, to hold the wire in position.

7.2 If a wire-binding screw is employed at a wiring terminal it shall not be smaller than M4 type [see IS 4218 (Part 2)] except that M3.5 type screw may be used for connection of a 1.00 mm, 1.32 mm or 1.60 mm wire.

7.3 The terminal plate for a wire-binding screw shall be of metal not less than 0.8 mm in thickness; and there shall be not less than two full threads in the metal.

7.4 A wire-binding screw shall not thread into material other than metal.

7.5 Terminals shall be secured to their supporting surfaces by methods other than friction between surfaces so that they will be prevented from turning.

8 CLEARANCES

8.1 The clearances shall be not less than those indicated in Table 1. Greater clearances may be required if the enclosure, because of its size, shape, or the material used, is not considered to be sufficiently rigid to warrant the minimum clearances.

8.2 Except as specified in 8.3, an insulating barrier or liner used as the sole separation between uninsulated live parts and earthed metal parts (including the enclosure) or between uninsulated live parts of opposite polarity, shall be of a material which is suitable for the mounting of uninsulated live parts and not less than 0.8 mm in thickness.

8.3 Except as specified in 8.4, an insulating barrier or liner, which is used in addition to an air clearance in lieu of the required clearance through air, shall be not less than 0.8 mm in thickness. If the barrier or liner is of fibre, the air clearance shall be not less than 0.8 mm, and if the barrier or liner is of other material of a type which is not suitable for the support of uninsulated live parts, the air clearance provided shall be adequate for the particular application.

8.4 A barrier or liner which is used in addition to not less than one-half the required clearance through air may be less than 0.8 mm but not less than 0.4 mm in thickness provided that the barrier or liner is of material of a type which is suitable for the mounting of uninsulated live parts of adequate mechanical strength if exposed or otherwise liable to be subjected to mechanical injury, reliably held in place, and so

located that it will not be affected adversely by operation of the equipment in service.

9 INSULATING MATERIAL

9.1 Material for the mounting of live parts shall be of phenolic composition, cold-moulded composition, or one which is recognized as suitable for the application with respect to moisture resistance, combustibility and dielectric strength.

9.2 Vulcanized fibre is not considered suitable as the sole support for live parts.

10 CORROSION PROTECTION

10.1 All iron and steel parts, except those parts like bearings, where such protection is impracticable, shall be suitably protected against corrosion by enamelling, galvanizing, sherardizing, plating, or other equivalent means.

10.2 The requirements of 10.1 apply to all enclosing cases whether of sheet steel or cast iron, to all iron or steel current carrying parts, and to all springs and other parts upon which proper mechanical operation may depend. It does not apply to small minor parts of iron or steel, such as washers, screws, and the like; but the protection of all such parts is recommended.

11 SPRINGS

11.1 The functioning of a device to prevent movement of the car shall not depend on the motion of a spring or springs in tension or torsion.

11.2 Compression springs shall be restrained to prevent displacement from their proper position.

12 MARKING

12.1 Each device shall be clearly marked on a nameplate, which is permanently secured to the device in a location, which is visible, when

Table 1 Minimum Clearances
(Clause 8.1)

Parts (1)	Nature of Clearances (2)	Potential Involved		
		51-150V mm (3)	151-300V mm (4)	301-600V mm (5)
Between any uninsulated live part and an uninsulated live part of opposite polarity, uninsulated earthed part other than the enclosure, or exposed metal part	Through air	3.1 ¹⁾	6.2	9.6
	Over surface	6.2	9.6	12.7
Between any uninsulated live part and the walls of a metal enclosure, including fittings for conduit of armoured cable ²⁾	Shortest distance	12.7	12.7	12.7

¹⁾The clearance between wiring terminals of opposite polarity and the clearance between a wiring terminal and an earthed metal part shall be not less than 6.2 mm if short-circuiting or earthing of such terminals may result from projecting strands of wire.

²⁾For the purpose of this requirement, a metal piece attached to the enclosure is considered to be a part of the enclosure if deformation of the enclosure is liable to reduce clearance between the metal piece and uninsulated live parts.

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in a location, which is visible, when the device is installed, with the following information:

- a) Manufacturer's name or trade-mark,
- b) Distinctive type or model designation, and
- c) Rated voltage.

12.2 A device of a type, which is released by a retiring cam, shall be marked with its rated force and movement.

12.3 If a manufacturer produces lift door locking devices or contacts at more than one factory, each such assembly shall have a distinctive marking, which may be in code, by which it may be identified as the product of a particular factory.

13 TESTS

13.1 General

13.1.1 All the tests specified in **13.2** to **13.8** shall constitute the type tests. These tests shall be carried out as acceptance tests for every thousand interlocks or part thereof.

13.1.2 In the tests given under **13.3** to **13.7** the devices are to be operated by a special lift component test mechanism except where otherwise specified. This mechanism subjects the tested device to operation similar to that of normal service. The cam, linkage, vane or other actuating means is preferably to be as specified by the manufacturer, but alternative actuating means may be employed.

13.1.3 The number of devices to be used for each of the tests shall be as follows:

Force and movement test (see 13.2)	} One Device
Endurance test (see 13.3)	
Current interruption test (see 13.4)	
Test for operation in moist atmosphere (see 13.5)	One device
Test for operation without lubricant (see 13.6)	One device

Retiring cam or equivalent devices for operating the mechanism need not be tested

NOTE — Number of samples, on which tests specified in **13.7** and **13.8** are to be carried out is under consideration.

13.1.4 The samples shall successfully pass the tests to which they are subjected. No excessive wearing or loosening of parts, nor undue burning or pitting of contacts shall occur as a result of the tests.

13.2 Force and Movement Test

13.2.1 When testing a device of a type which is released by retiring cam, measurements shall be made for the force required to release the device and of the movement of the element engaged by the cam with the device mounted in its normal position as specified by the manufacturer, before and after endurance test.

13.2.2 The average of the measured forces and movements shall be not more than the values marked on the device (see **12.2**).

13.2.3 The force and movement recorded in each test shall be respectively:

- a) The maximum force, measured in a horizontal plane, which must be applied to that member of the device which is directly actuated by the cam to release the door locking member of the device from locking engagement; and
- b) the distance, projected in a horizontal plane, which the member of the device directly actuated by the cam travels from its position when the lock is fully engaged to its position when the locking member is released from engagement.

13.3 Endurance Test

13.3.1 The interlock and contacts with initial lubrication and adjustment only shall withstand the endurance test as described in **13.3.2** without failure of any kind. This test shall be carried out before and after force and movement test specified in **13.2**.

13.3.2 The sample should be operated for 1 000 000 times. During the test, the electric contacts are to make (but not break) a non-inductive direct-current circuit maintained at 0.5 ampere at operating voltage.

13.4 Current Interruption Test

The interlock and contacts shall withstand a current-interruption test as described in **13.4.1** after the endurance test, without failure.

13.4.1 The test arrangement is unchanged from the endurance test except that the electric contacts are to make and break a non-inductive direct-current circuit maintained at 2 amperes at operating voltage. The sample shall be operated for 1 000 cycles.

13.5 Test for Operation in Moist Atmosphere

The interlock and contact shall withstand to a test for operation in moist atmosphere as described in **13.5.1** to **13.5.4** without failure.

13.5.1 The device fully lubricated, shall be operated for 10 000 times for a wearing-in run operation, with the electric contacts making (but not breaking) a non-inductive direct-current circuit maintained at 0.5 ampere at operating voltage.

13.5.2 The device, except self-lubricating bearings and bearings of a type not requiring frequent replenishment of the lubricant, shall be taken apart and freed of lubricant by washing in carbon tetrachloride or other non-flammable liquid having similar cleansing characteristics.

13.5.3 After re-assembling, the device shall be subjected, continuously in an unventilated enclosure, to an atmosphere saturated with saturated solution of potassium sulphate for 72 h. During this period it shall be manually operated for 10 cycles at the end of each of the first two 24-h periods and is to be allowed to stand exposed to the inside air for 24 h. The device shall not fail in a manner that creates an unsafe condition.

13.5.4 The device shall be again lubricated and, without adjustment and without further attention complete 15 000 operations with the electric contacts making (but not breaking) a non-inductive direct-current circuit maintained at 0.5 ampere at operating voltage without failure.

13.6 Test for Operation without Lubricant

Each interlock and contact shall complete a test without lubricant as described in **13.6.1** to **13.6.4** without failure.

13.6.1 If the device employs only self-lubricating bearings or bearings of a type not requiring frequent replenishment of lubricant, this test may be waived.

13.6.2 The fully lubricated device shall be operated for 100 000 times for a wearing-in run operation, with the electric contacts making (but not breaking) a non-inductive direct-current circuit maintained at 0.5 ampere at operating voltage.

13.6.3 The device, except self-lubricating bearings and bearings of a type not requiring frequent replenishment of lubricant, shall then be taken apart and freed of lubricant by washing in carbon tetrachloride or other non-flammable liquid having similar cleansing characteristics.

13.6.4 After re-assembling and without adjustment other than the usual initial adjustment (that is, without adjustment especially made to meet the conditions of this particular test) the device shall withstand 25 000 operations with the electric contacts making (but not breaking) a non-inductive direct-current circuit maintained at 0.5 ampere at operating voltage.

13.7 Test for Misalignment

13.7.1 Each interlock and contact shall operate effectively when the cam or other equivalent operating device has been misaligned as described in **13.7.1.1** (*see 13.7.4*).

13.7.1.1 The operating device used in tests specified in **13.3** to **13.6**, is to be displaced horizontally from its normal position (the position in which it was when installed for the tests) successively as follows:

- a) In a direction perpendicular to the plane of the door opening:
 - Backward 6.4 mm
 - Forward 6.4 mm

- b) In a direction parallel with the plane of the door opening:

- To the right 6.4 mm
- To the left 6.4 mm

13.7.2 Each interlock and contact for use with horizontally sliding doors shall operate effectively when the door has been misaligned as described in **13.7.2.1** and **13.7.2.2** (*see 13.7.4*).

13.7.2.1 The bottom of the test door is to be displaced horizontally from its normal position in a direction perpendicular to the plane of the door opening as follows:

- Backward 6.4 mm
- Forward 6.4 mm

13.7.2.2 The top of the door is to be displaced horizontally from its normal position in a direction perpendicular to the plane of the door opening as follows:

- Backward 3.2 mm
- Forward 3.2 mm

13.7.3 Each interlock and contact for use with vertically sliding doors shall operate effectively when the door has been misaligned as specified in **13.7.3.1** (*see 13.7.4*).

13.7.3.1 The test door is to be displaced from its normal position as follows:

- a) In a direction perpendicular to the plane of the door opening as follows:
 - Backward 3.2 mm
 - Forward 3.2 mm
- b) In a direction parallel with the plane of the door opening as follows:
 - To the right 3.2 mm
 - To the left 3.2 mm

13.7.4 With reference to **13.7.1** to **13.7.3** compliance with these requirements may be determined by establishing that the relative position of the parts and the clearance provided assure that misalignment of the device (or door) as specified will not affect the operation of the device.

13.8 High Voltage Test

The device shall withstand, without breakdown for one minute, the application of a 50 Hz 1 000 V, ac plus twice the rated voltage with a minimum of 2 000 V between live and metal parts.

14 LIFT DOORS

14.1 Type of Doors

The doors provided in a lift installation shall be any one of the following types:

- a) Horizontally sliding,
- b) Vertically sliding, or
- c) Swing.

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14.2 Car Doors

The car doors provided in a lift installation shall be any one of the following types:

- a) Horizontally sliding, or
- b) Vertically sliding.

14.3 Landing Doors

The landing doors provided in a lift installation shall be any one of the following types:

- a) Horizontally sliding,
- b) Vertically sliding, or
- c) Swing.

15 REQUIREMENTS

15.1 Landing Doors

15.1.1 The landing doors shall be imperforate.

Special Case — Goods lifts used in industrial premises may use collapsible doors or vertically sliding landing doors. The collapsible type landing doors shall be of a close picket type and no openings exceeding 5.5 cm in width shall be permitted between the vertical members of the doors when they are fully extended.

15.1.2 The distance between the lift well side of the car door and the lift well side of the landing door shall not exceed 13 cm; where the car door or the landing door consists of two or more panels, the 13 cm dimensions shall apply to the door panel nearest to the side edge. The distance between the car and the landing sills shall not exceed 30 mm.

15.1.3 The opening for the landing doors shall be not wider than that of the width of lift car. Minimum landing door opening width and height shall be 0.7 m and 2 m respectively.

15.1.4 The landing doors shall be securely fixed.

15.2 Car Doors

15.2.1 The car doors shall be imperforate.

Special Case — Goods lifts used in industrial premises may use collapsible doors or vertically sliding car doors and these may be in mesh or perforated panel form. The dimensions of the mesh or perforations shall not exceed 10 mm horizontally and 60 mm vertically. Collapsible door for car shall be of close picket type and no openings exceeding 5.5 cm in width shall be permitted between the vertical members of the doors when they are fully extended.

15.2.2 Manual Opening of Car Doors

Where lift car has more than one entrance, the car door shall have an electromechanical lock to prevent opening at landings that it does not serve.

16 MATERIAL

All doors shall be made of metal construction for power operated doors and metal/wooden construction for manually operated doors.

17 STRENGTH OF DOORS

All doors including their tracks shall withstand a thrust of 345 N applied normally at any point excepting any vision panel without permanent deformation and without the doors being sprung from their guides. For collapsible doors, this thrust may be applied at points on two adjacent pickets so as to divide the load equally.

18 CONSTRUCTION

18.1 Horizontally Sliding Door

18.1.1 Horizontally sliding doors shall be any one of the following types:

- a) Single panel door;
- b) Centre opening, two-panel door;
- c) Multipanel door; or
- d) Midbar collapsible gate.

18.1.2 All horizontally sliding landing doors shall be of overhung type properly guided both at top and bottom and shall run on overhead track secured rigidly by suitable means. The door shall not be sprung from their guides or tracks in normal service.

18.1.3 Overhanging of doors shall be effected by means of rollers — a minimum of two numbers of rollers to be used for each panel — attached to hangers or other suitable means and stops shall be provided to the doors from leaving the ends of the tracks. Hangers and tracks shall be so designed and installed as to support the door in case of fire.

18.1.4 Bottom door slippers made of suitable non-metallic material shall be provided to every panel of the door and shall be so placed as to meet the requirements of **18.1.2**.

18.1.5 The leading edges of all horizontally sliding doors shall be smooth and free of sharp projections. The meeting or slamming edges may be provided with a soft material to give a cushioning effect.

18.1.6 Multiple panel horizontally sliding doors shall be so arranged as to ensure simultaneous movement of all panels. When coupling is by chain or rope, means shall be provided to ensure that all sections of the doors are properly closed and locked in order to meet the requirements of **5.1.11**.

18.1.7 For collapsible gates, when used, the following conditions in addition to clauses given above shall also apply.

- a) The gate shall be of closed picket type;
- b) The space between pickets shall not be more than 55 mm; and
- c) Gates shall be provided with handles, on both sides; of sufficient depth to allow for a positive grip.

18.1.8 Suitable sills shall be provided at the bottom and shall have guide ways to guide the doors and shall be of sufficient length so that the doors do not come out of the sill during operation.

18.2 Vertically Sliding Doors

18.2.1 Vertical sliding doors shall be of the following types:

- a) Vertical lifting, or
- b) Vertical biparting.

18.2.2 Vertical sliding doors shall be properly supported and guided so that they will not be displaced from their guides either in normal service or when a constant horizontal force of 345 N is applied at right angles to any part of the door face other than vision panel.

18.2.3 The vertical sliding door which slides down to open shall be provided with bottom stops capable of withstanding safely, the impact of the door in case the door falls by breakage of suspension means, without allowing the door to leave the guides.

18.2.4 Vertical door panel, which slides down to open and forms a sill, shall be so designed as to withstand the loads during loading and unloading.

18.2.5 The doors shall be provided with handgrips on the inside and outside to allow for a positive grip.

18.2.6 Vertical sliding doors shall be so counter-balanced that they will not open or close by gravity.

18.2.7 The counterweight, when used for balancing the door, shall be enclosed or guided throughout its travel and shall have bottom stops capable of withstanding the impact of the door counterweight, should it fall by the breakage of suspension means without allowing the weight to leave the guides or the enclosure.

18.2.8 The door section and door counterweight shall be suspended by steel rope or roller chain or other approved material and the suspension means and the connections shall have a factor of safety not less than 5 based on static loading. A minimum of 2 steel ropes or chains independently fastened to the doors shall be provided.

18.3 Swing Doors

Swing doors provided for a lift entrance shall comply with the following requirements.

18.3.1 Stops shall be provided to the doors, which stop the door sections when closed so that the clearance between car and landing door shall comply with **15.1.2**.

18.3.2 The doors shall withstand the forces specified in **17** and the forces resulting from the normal opening of the door or normal attempts to open it when in the closed position.

18.4 Locking Devices for Landing Doors

Every landing door shall be fitted with a locking device in accordance with IS 14665 (Part 4/Sec 4) and shall comply with all the requirements given therein.

18.5 Car Door Contact

Every car door or gate shall be provided with a car door electrical contact in accordance with IS 14665 (Part 4/Sec 4) and shall comply with all the requirements given therein.

18.6 Door Vision Panel

Vision panel shall not be provided on power operated doors. However manually operated vertically sliding, horizontally sliding or swing type doors may be provided with a vision panel, if required. Area of a vision panel in a single door shall not be less than 175 cm². Panel opening shall be covered with wired/toughened glass not less than 5 mm thick.

19 POWER OPERATION OF DOORS

Power operated doors are recommended for lifts having speed 1 m/s and above.

19.1 Power Operation of Horizontally Sliding Doors

19.1.1 Car and landing doors, which are both opened and closed automatically, shall be of same horizontally sliding type and shall be coupled together so that they open and close simultaneously. The doors shall further be subjected to the following conditions.

19.1.2 Opening shall occur only at the landing within the levelling zone and when the car is stopping or stopped or at rest.

19.1.3 A momentary pressure switch shall be provided in the car, the operation of which shall cause the closing door to stop and reopen.

19.1.4 Power-operated car doors on automatically operated lifts shall be so designed that their closing and opening is not likely to injure a person. The power operated car door shall be provided with a sensitive device which shall automatically initiate reopening of the door in the event of passenger being struck (or about to be struck) by the door, while crossing the entrance during the closing movement. The effect of the device may be neutralized:

- a) during the last 58 mm of travel of each door panel in the case of side opening of the door,
- b) when the panels are within 58 mm of each other in case of centre opening of doors, and
- c) the force needed to prevent the door closing shall not exceed 150 N. This measurement shall not be made in the first third of the travel of the door.

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19.1.5 When more than one entrance at any landing level is provided, a separate mechanism shall be used for each pair of car and landing doors.

19.2 Power Operation of Vertical Sliding Doors

19.2.1 Power operation of vertical sliding doors shall be effected by providing continuous pressure on open and close buttons at every landing, the release of which at any time shall cause the door to stop.

19.2.2 There shall be two sets of buttons for car and landing doors at every landing and inside the car.

19.2.3 *Sequence Power Closing for Vertically Sliding Doors*

Power operated vertically sliding car doors are used with power operated vertically biparting landing doors sequencing, that is one after the other is required. The car doors shall close before the landing doors start to close and open after the landing doors have opened when operating from landing and vice versa, when operated from car.

19.3 Mid-bar collapsible gate shall not be provided with a power operated device.

**AMENDMENT NO. 4 SEPTEMBER 2011
TO
IS 14665 (PART 4/SEC 6) : 2001 ELECTRIC
TRACTION LIFTS**

PART 4 COMPONENTS

Section 6 Lift Doors, Locking Devices and Contacts

(Page 21, clause 19.1.4) — Substitute the following for the existing:

‘Power operated car doors on automatically operated lifts shall be so designed that their closing & opening is not likely to injure a person. The power operated car door shall be provided with a sensitive device which shall automatically initiate reopening of the door in the event of passenger being struck (or about to be struck) by the door, while crossing the entrance during closing movement. In order to achieve this it is desirable that all power operated doors have a full length (covering at least 1 600 mm of car door height from bottom) infra red light curtain safety to retract the door in the event of coming across any obstacle during closing of the door. The effect of the device may be neutralized:

- a) during the last 58 mm of travel of each door panel in the case of side opening of the door,
- b) when the panels are within 58 mm of each other in case of centre opening of doors,
- c) the force needed to prevent the door closing shall not exceed 150 N. This measurement shall not be made in the first third of the travel of the door, and
- d) during emergency fire operation phase 2.’

*Indian Standard***ELECTRIC TRACTION LIFTS****PART 4 COMPONENTS****Section 7 Lift Machines and Brakes****1 SCOPE**

This standard (Part 4/Sec 7) covers the requirements of the lift machines and brakes used in passenger and goods lifts.

2 REFERENCES

The following Indian Standards contain provisions which, through reference in this text, constitute provisions of this standards. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
2742 : 1964	Automotive brake lining.
14665 (Part 2/ Sec 1) : 2000	Electric traction lifts: Part 2 code of practice for installation, operation and maintenance, Section 1 passenger and goods lifts

3 TERMINOLOGY

For the purpose of this standard, the following definitions, in addition to those given in IS 14665 (Part 2/Sec 1) shall apply.

4 LIFT MACHINES

4.1 No friction gearing, belt, chain, clutch or chain driven mechanism shall be used for connecting the main driving gear to the traction sheaves.

4.2 The motor of each lift machine or the worm shaft shall be arranged so as to provide hand-winding facilities and shall be suitably marked for the direction of up and down travel of the lift car.

4.3 Use of Overhung Pulleys

In the case of the use of overhung traction sheaves, effective precautions shall be taken to avoid the following:

- a) The ropes leaving their grooves, and
- b) Objects lodging between the grooves and the ropes in the case where the machine is not above the well.

These precautions shall not prevent examination and servicing of traction sheaves and sprockets.

4.4 Protection of Machinery

Effective protection shall be provided for accessible rotating parts, which may be dangerous, in particular:

- a) Keys and screws in the shafts, and
- b) Projecting motor shafts.

Exception is made for traction sheaves, hand-winding wheels, brake drums and any similar smooth round parts. Such items shall be painted yellow at least in part.

4.5 A fillet shall be provided at any point of change in the diameter of driving machine shafts and sheave shafts to prevent excessive stress concentrations in the shafts.

4.6 Shafts which support sheaves, gears, couplings and other members, which transmit torque, shall be provided with tight-fitting keys.

5 BRAKES**5.1 General**

Brake shall be provided in all lift machines to prevent the rotation of the lift motor and thus preventing any drive to the lift car when there is no power supply to the lift motor.

5.2 Construction

The brake essentially consists of two brake shoes on which brake linings are secured. The shoes apply pressure on the brake drum with the aid of compression spring/springs or weights. They are moved to release the pressure on the brake drum by means of an electromagnet or an electrical motor directly or through a set of levers.

5.3 Operation

The brakes provided in the lift machines shall be of mechanically operated type, which are released by an electromagnet or an electrical motor.

5.4 Material

All materials used shall conform to the relevant Indian Standards.

5.5 Requirements

5.5.1 There shall be no friction drive interposed between the brake drum and the traction sheave.

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5.5.2 The brake shall be capable of sustaining a static load equivalent to 125 percent of the rated load in the lift car, that is, it should be capable of preventing the lift car from movement with a load of 125 percent of the rated load, with the lift car at rest.

5.5.3 No toggle mechanism shall be used in the operation of the brake.

5.5.4 When spring/springs are used to apply the brake, they shall be of the compression type and shall be adequately guided and supported.

5.5.5 The brake lining used shall be of fire-proof material and shall be so secured to the shoes that their normal wear shall not weaken their fixings. They shall conform to IS 2742.

5.5.6 The brake shall not be released under any circumstances unless electric power is applied to the lift motor. Any electrical fault in the electrical brake circuit shall not prevent the brake from being applied when power supply to the lift motor is interrupted.

5.5.7 A continuous flow of current is required to hold off the brake when the lift is in normal use

5.5.8 The interruption of this current shall be effected by at least two independent electrical devices, whether or not integral with those which cause interruption of the current feeding the lift machine.

If, when the lift is stationary, one of the contractors has not opened the main contacts, further movement shall be prevented, at the latest at the next change in the direction of motion.

5.5.9 Braking shall become effective without supplementary delay after opening of the brake release circuit (The use of a diode or a capacitor connected directly to the terminals of the brake coil is not considered as a means of delay).

5.5.10 Provision shall be made for releasing the brake manually in case of emergency. As soon as the hand pressure is released, brake should be applied immediately.

5.5.11 Band brakes are forbidden.

6 ELECTRIC TESTS

6.1 Insulation Resistance Test

The insulation resistance shall be measured for the electromagnet between the yoke and the two leads of the coil shorted together and for electric motor between the body and the winding terminals shorted together. The value of the insulation resistance shall be 1M Ω minimum when tested with 500 V dc insulation tester.

6.2 High Voltage Test

The brake coil or brake motor shall be capable of withstanding the high voltage test as described below: An ac potential of 2 000 V rms at 50Hz shall be applied between the yoke and the two leads of the coil shorted together in case of an electromagnet and between body and the winding terminals shorted together in case of an electric motor for a period of 1 min. The test shall be commenced at a voltage of less than one-third of test voltage and shall be increased gradually to the full voltage.

This test shall be conducted only at the works, the voltage applied shall be 25 percent less than that applied at the first instance that is 1 500 V only and the duration shall be for only 5 s.

7 MARKING

Brakes for lifts shall be marked with the manufacturer's name, brand name or trade-mark.

*Indian Standard***ELECTRIC TRACTION LIFTS****PART 4 COMPONENTS****Section 8 Lift Wire Ropes****1 SCOPE**

This standard (Part 4/Sec 8) covers the requirements for steel wire ropes for use with

lifts for suspension, compensation and governor roping. The following rope constructions and size ranges are covered:

Construction	Tensile Designation			Fibre	Core	Size	Ref to
	1 230	1 420	1 570				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
6 × 19 (12/6/1)	X	X	X	X	—	6 to 12	1
6 × 19 (9/9/1)	X	X	X	X	—	6 to 20	2
6 × 19 (12/6/1)	X	X	X	X	—	6 to 20	2
6 × 19 (12/6F/1)	X	X	X	X	—	6 to 20	3
8 × 19 (9/9/1)	X	X	X	X	—	8 to 20	4
8 × 19 (12/6/1)	X	X	X	X	—	8 to 20	4
8 × 19 (12/6+6F/1)	X	X	X	X	—	8 to 20	5

2 TERMINOLOGY

The following definitions in addition to that given in IS 2363 : 1981 'Glossary of terms relating to wire ropes (*first revision*)' shall apply.

2.1 Crown Wire

A strand on the periphery of the rope.

2.2 Pitch or Length of Lay

The distance parallel to the axis of the rope (or strand), in which a strand (or wire) makes one complete helical convolution about the core (or centre).

2.3 Rope Life

Lift rope life depends upon a multitude of factors and may extend over periods ranging from a few months to several years. Although it is quite general practice to express life of wire ropes in terms of the time they have been in service, this method is not so accurate a measure as car travel. Here again, car travel is not the same as rope travel as for example, in 2:1 roping, rope travel is twice the car travel. Further, the number of reverse bends has a decided influence on the life of rope.

3 ROPE SIZE AND TOLERANCE

The size of the rope, designated as 'nominal diameter' shall be one of these given in Tables 1 to 5. The actual diameter of the rope as supplied shall be within +4 to -1 percent of the nominal diameter.

3.1 The minimum breaking load shall be as given in Tables 1 to 5.

4 GENERAL REQUIREMENTS

The wire ropes shall conform to IS 6594 : 1981 'Magnesium ingot for remelting (*first revision*)' and shall also meet the following requirements.

4.1 Core

The main core of the rope shall be of fibre only.

4.2 Joints

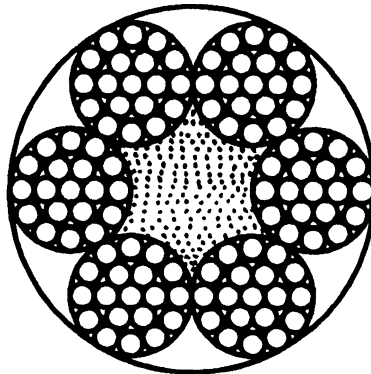
If jointing by tucking is required, it shall be in the case of wires 0.5 mm diameter and smaller.

4.3 Mass

The mass of ropes given in Tables 1 to 5 are for fully greased ropes. The ropes, which are not lubricated, may be lighter.

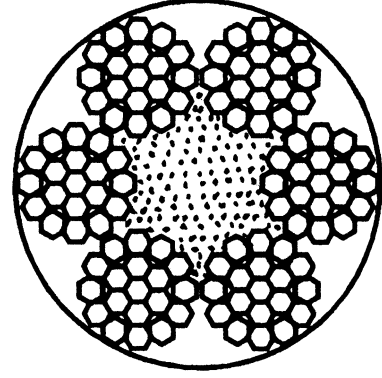
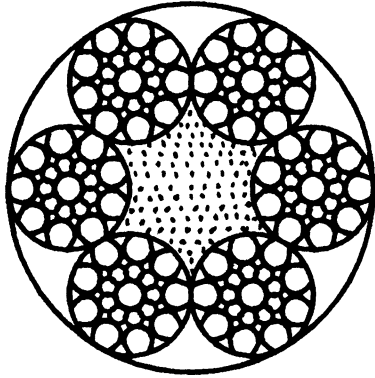
IS 14665 (Part 4/Sec 8) : 2001

Table 1 Breaking Load and Mass for 6 × 19 (12/6/1) Construction
(*Clauses 1 and 3*)



Nominal Diameter	Approximate Mass	Minimum Breaking Load Corresponding to Tensile Designation of Wires of		
		1 230	1 420	1 570
mm	kg/100 m	kN	kN	kN
(1)	(2)	(3)	(4)	(5)
6	12.5	13.6	15.7	17.4
7	17.0	18.5	21.0	24.0
8	22.1	24.0	28.0	31.0
9	28.0	31.0	35.0	39.0
10	34.6	38.0	44.0	48.0
11	41.9	46.0	53.0	58.0
12	49.8	54.0	63.0	69.0

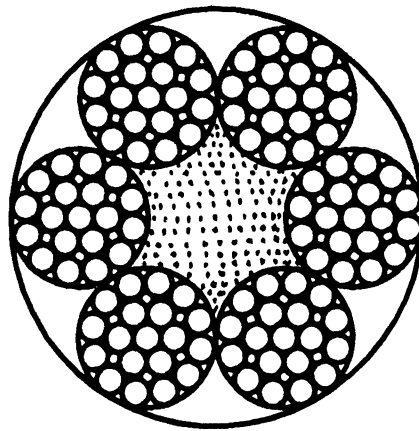
Table 2 Breaking Load and Mass for
1) 6 × 19 (9/9/1) Construction
2) 6 × 19 (12/6/1) Construction
 (Clauses 1 and 3)



Nominal Diameter	Approximate Mass	Minimum Breaking Load Corresponding to Tensile Designation of Wires of		
		1 230	1 420	1 570
mm	kg/100 m	kN	kN	kN
(1)	(2)	(3)	(4)	(5)
6	13.4	14.7	16.9	18.7
7	18.3	19.9	23.0	25.0
8	23.8	26.0	30.0	33.0
9	30.2	33.0	38.0	42.0
10	37.3	41.0	47.0	52.0
11	45.1	49.0	57.0	63.0
12	53.7	59.0	68.0	75.0
13	63.0	69.0	79.0	88.0
14	73.0	80.0	92.0	102.0
16	95.4	104.0	120.0	133.0
18	121.0	132.0	152.0	168.0
19	135.0	147.0	170.0	188.0
20	149.0	162.0	188.0	208.0

NOTE — The nominal diameter 19 mm is non-preferred.

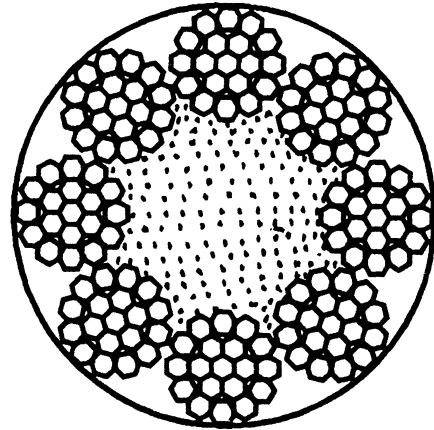
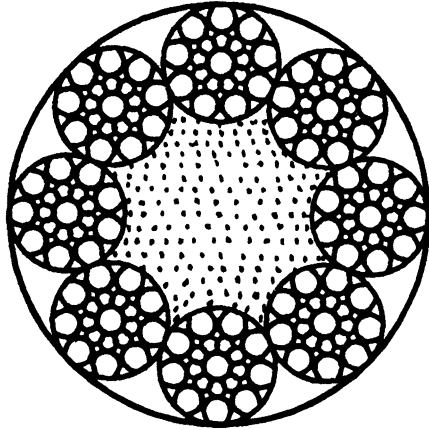
Table 3 Breaking Load and Mass for 6 × 19 (12/6+6F/1) Construction
(Clauses 1 and 3)



Nominal Diameter	Approximate Mass	Minimum Breaking Load Corresponding to Tensile Designation of Wires of		
		1 230	1 420	1 570
mm	kg/100 m	kN	kN	kN
(1)	(2)	(3)	(4)	(5)
6	13.7	15.0	17.3	19.1
7	18.6	20.4	23.0	26.0
8	24.3	27.0	31.0	34.0
9	30.8	34.0	39.0	43.0
10	38.0	42.0	48.0	53.0
11	46.0	50.0	58.0	64.0
12	54.7	60.0	69.0	76.0
13	64.3	70.0	81.0	90.0
14	74.5	81.0	94.0	104.0
16	97.3	106.0	123.0	136.0
18	123.0	135.0	155.0	172.0
19	137.0	150.0	173.0	191.0
20	152.0	166.0	192.0	212.0

NOTE — The nominal diameter 19 mm is non-preferred.

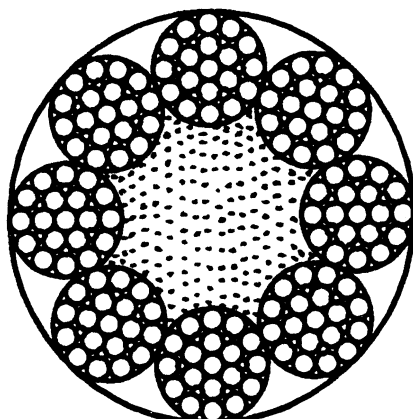
Table 4 Breaking Load and Mass for
1) 8 × 19 (9/9/1) Construction
2) 8 × 19 (12/6/1) Construction
 (Clauses 1 and 3)



Nominal Diameter	Approximate Mass	Minimum Breaking Load Corresponding to Tensile Designation of Wires of		
		1 230	1 420	1 570
mm	kg/100 m	kN	kN	kN
(1)	(2)	(3)	(4)	(5)
8	22.3	23.0	26.0	29.0
9	28.2	29.0	33.0	37.0
10	34.8	35.0	41.0	45.0
11	42.2	43.0	49.0	55.0
12	50.2	51.0	59.0	65.0
13	58.9	60.0	69.0	76.0
14	68.3	69.0	80.0	88.0
16	89.2	90.0	104.0	115.0
18	113.0	114.0	132.0	146.0
19	126.0	127.0	147.0	163.0
20	139.0	141.0	163.0	180.0

NOTE — The nominal diameter 19 mm is non-preferred.

Table 5 Breaking Load and Mass for 8 × 9 (12/6+6F/1)
(Clauses 1 and 3)



Nominal Diameter	Approximate Mass	Minimum Breaking Load Corresponding to Tensile Designation of Wires of		
		1 230	1 420	1 570
mm	kg/100 m	kN	kN	kN
(1)	(2)	(3)	(4)	(5)
8	22.8	23.0	27.0	30.0
9	28.9	29.0	34.0	37.0
10	35.7	36.0	42.0	46.0
11	43.1	44.0	50.0	56.0
12	51.3	52.0	60.0	66.0
13	60.2	61.0	70.0	78.0
14	69.9	71.0	82.0	90.0
16	91.3	92.0	107.0	118.0
18	116.0	117.0	135.0	149.0
19	129.0	130.0	151.0	166.0
20	143.0	144.0	167.0	184.0

NOTE — The nominal diameter 19 mm is non-preferred.

5 INSPECTION

This section provides guidance for proper inspection of suspension, compensation and governor ropes of lifts.

It should be noted that it is not practicable to spell out the inspection procedure for every single type of wire rope installation nor to outline every detail of the inspection procedure. The inspector should use his best judgment in making the inspection and in selecting his location from which a proper examination of the rope can best be made.

6 CAUSE OF WEARING OUT OF ROPE

Wire ropes wear out from two causes:

- a) Breakage of the wires, and

- b) Reduction in area caused by wearing of the outside wires.

In normal practice, the former is more predominant.

7 METHODS OF INSPECTION

7.1 Before starting inspection, all dirty and over-lubricated ropes should be cleaned. A hand lamp with a special clamp, which can be anchored with the lift rope, may be used for inspection purposes.

7.2 For traction machines, the ropes on counterweight side from top of the car, with the car located at the top of the lift shaft, should be examined.

7.3 For basement drive machine the portions of the ropes leading from the driving machine

sheave and from the counterweight to the overhead wheels should be examined from the car top as the car descends. A small portion left shall be examined from the pit.

7.4 A convenient method of indicating the location of the unexamined sections of ropes, which should be examined later from the machine room or overhead machinery space or from pit is to mark the rope with a chalk.

7.5 The car should be moved downward one or two metres at a time and rope at each of these stops should be examined.

7.6 It should be noted when broken wires begin to appear. Thereafter, at frequent time intervals the rate of increase in the number of broken wires should be determined. Any rapid increase in the number of broken wires is significant, but frequently after a rapid increase, the number of broken wires will remain relatively constant for a considerable period of time.

7.7 The number of broken crown wires in a pitch of lay measured along the length of a rope should be counted. A pitch of lay may be considered as a section of rope approximately six and a half times the diameter of the rope.

8 CONDEMNATION OF ROPES

8.1 For single or double wrapped traction machines discard suspension or compensating ropes under any one of the following conditions:

- a) If the broken wires are equally distributed among the strands, when the number of broken wires per pitch of lay in the worst section of rope exceeds the values shown under *A* in Table 6.
- b) If four or five wires, side by side, are broken across the crown of any strands, when the number of broken wires per pitch of lay in the worst section of rope exceeds values shown under *B* of Table 6.
- c) If the distribution of broken wires is unequal and broken wires predominate in one or two strands, when the number of broken wires per pitch of lay in the worst section of the rope exceeds the values shown under *C* of Table 6.
- d) If any unfavourable factors, such as corrosion (red dust or rouge), excessive wear of individual wires in the strands, unequal tension, poor sheave grooves, etc, exist and when the number of broken wires exceeds 50 percent of the values indicated in Table 6 for conditions (a), (b) and (c) described above.

8.2 The ropes should be discarded whenever their actual diameter drops below the value shown in Table 7.

Table 6 Number of Broken Wires for Condemnation

[Clause 8.1 (d)]

Type of Wire Rope	Number of Broken Wire		
	<i>A</i>	<i>B</i>	<i>C</i>
(1)	(2)	(3)	(4)
6 × 19	24-30	12-20	8-12
8 × 19	32-40	16-24	10-16

NOTE — The upper limits are used when inspections are made at least monthly by a competent person.

Table 7 Reduction of Diameters

(Clause 8.2)

Nominal Diameter, mm	Actual Reduced, Diameter, mm
12	11.2
14	13.2
16	14.8
18	16.8
20	18.8
25	23.4

8.3 Governor ropes should be inspected and discarded in the manner outlined in 8.1 for suspension and compensating ropes of traction machines.

9 CAUTION

9.1 Breaks in the valleys of the ropes, while infrequent, may be an indication of internal breaks. The ropes should be discarded when the total number of broken wires in the valleys of a rope lay exceeds one.

9.2 A valley break is one in which the outside wire of a strand breaks in the immediate vicinity of the point where it contacts a wire or wires of an adjacent strand, generally at a point not visible when the wire rope is examined externally. In other words, one broken end of the wire is long enough to reach from one valley to the next one and the other end of the break generally cannot be seen. This is not to be confused with a broken outside wire when the original break occurred at a worn crown and a secondary fracture has occurred near the point where two adjacent strands make contact. In this case, a piece of wire has broken out and is missing, and generally both ends of the broken wire remaining are visible.

9.3 It should be noted that where preformed rope is used, greater care is required on inspection in order to detect broken wires, which do not protrude from the surface of the rope.

9.4 Internal breakage of wire in ropes is difficult to detect and consequently may be a greater hazard than surface wear. The surface

IS 14665 (Part 4/Sec 8) : 2001

of the rope may show little or no wear, but if the rope is bent over a short radius, the individual wires will snap and in extreme cases the rope wires may be broken by hand. Such failures are more likely to occur in governor and compensating ropes where the ropes are lightly loaded and the ratio of sheave to rope diameter is small.

10 REPLACEMENT

When replacing suspension and compensating ropes, all ropes in a set should be replaced. All the ropes in the set should be from the same manufacturer and of the same material, grade, construction and diameter and preferable be cut from the same reel.

*Indian Standard***ELECTRIC TRACTION LIFTS****PART 4 COMPONENTS****Section 9 Controller and Operating Devices for Lifts****1 SCOPE**

This standard (Part 4/Sec 9) covers the requirements of controller and operating devices for lifts.

2 CONTROLLERS AND OPERATING DEVICES

2.1 The stopping of the lift machine or stopping the main circuit shall be controlled as detailed below.

2.1.1 Motor Supplied Directly from AC or DC Mains

The supply to the motor shall be interrupted by two independent contactors, the contact of which shall be in series in the motor circuit.

2.1.2 Drive Using a 'Ward-Leonard' System

Two independent contactors shall interrupt the excitation of the generator.

2.1.3 AC or DC Motor supplied and controlled by static elements. One of the following methods shall be used:

- a) Two independent contactors shall interrupt the current to the motor.
- b) A System consisting of:
 1. A contactor interrupting the current in all the phases. The coil of the contactor shall be released at least before each change in direction. If the contactor does not release, any further movement of the lift shall be prevented.
 2. A control device blocking the flow of energy in the static elements.
 3. A monitoring device to verify the blocking of the flow of energy each time the lift is stationary.

If during a normal stopping period, the blocking of the flow of energy by the static elements is not effective, the monitoring device shall cause the contactor to release and any further movement of the lift shall be prevented.

2.2 Operation of a spring or springs in tension or the completion of another electric circuit shall not be depended upon to break the circuit to stop the lift at the terminal landings.

2.3 The interruption of the electrical safety chain or safety circuit shall stop and shall prevent the movement of the car. In the event of an earth fault with any door open, the lift shall not operate.

2.4 Each lift machine operated by a polyphase ac motor shall be protected against phase reversal or failure. This shall not apply to an ac motor forming part of a motor generator. This protection shall be considered provided in the case of generator-field control having alternating current motor-generator driving motors, provided a reversal of phase does not cause the elevator driving machine motor to operate in the wrong direction. Controllers whose switches are operated by polyphase torque motors provide inherent protection against phase reversal or failure.

2.5 No control system shall depend upon the completion or maintenance of an electrical circuit for the interruption of the power supply to the lift motor and the application of the machine brake to stop the lift car:

- a) at the terminal floor, or
- b) when the emergency stop switch or other safety device is operated.

NOTE — This requirement does not apply to dynamic braking or to speed control.

2.6 All control circuits should be protected by fuses or otherwise protected against faults or overloads, independently of the main circuits.

2.7 The wiring of the controller shall conform to the latest provisions of *Indian Electricity Rules* and the voltage of any controller operating circuit shall not exceed the low voltage of 250 V as defined therein. The control circuit shall be suitably protected independently of the main circuit and it shall be so arranged that an earth fault or open circuit shall not create an unsafe condition.

2.8 The high voltage test shall be performed as given in IS 14665 (Part 3/Sec 1) : 2001 'Electric traction lifts: Part 3 Safety rules, Section 1 Passenger and goods lifts'.

**AMENDMENT NO. 1 MARCH 2003
TO
IS 14665 (PART 4/SEC 9) : 2001 ELECTRIC TRACTION
LIFTS**

PART 4 COMPONENTS

Section 9 Controller and Operating Devices for Lifts

(Page 33, clause 2.1) — Substitute the following for the existing clause:

2.1 The stopping of the lift machine or stopping the main circuit shall be controlled as detailed below.

2.1.1 *Motor Supplied Directly from AC or DC Mains*

The supply to the motor shall be interrupted by two independent contactors, the contact of which shall be in series in the motor circuit.

2.1.2 *Drive Using a 'Ward-Leonard' System*

Two independent contactors shall interrupt the excitation of the generator.

2.1.3 AC or DC Motor supplied and controlled by static elements. One of the following methods shall be used:

- a) Two independent contactors shall interrupt the current to the motor.
- b) A System consisting of:
 1. A contactor interrupting the current in all the phases. The coil of the contactor shall be released at least before each change in direction. If the contactor does not release, any further movement of the lift shall be prevented.
 2. A control device blocking the flow of energy in the static elements.
 3. A monitoring device to verify the blocking of the flow of energy each time the lift is stationary.

If during a normal stopping period, the blocking of the flow of energy by the static elements is not effective, the monitoring device shall cause the contactor to release and any further movement of the lift shall be prevented.'

Amend No. 1 to IS 14665 (Part 4/Sec 9) : 2001

(Page 33, clause 2.3) — Substitute the following for the existing clause:

2.3 The interruption of the electrical safety chain or safety circuit shall stop and shall prevent the movement of the car. In the event of an earth fault with any door open, the lift shall not operate.'

(ET 25)

(Continued from second cover).

14665

New IS Series

Superseding IS

Electric traction lifts:

Part 4 Components,

Section 2 Lift guide rails and guide shoes 10191 : 1982 Car and counterweight guide rails, guide rail supports and fastenings for lifts; and

11615 : 1986 Car and counterweight guide shoes for electric passenger and goods lifts

Section 3 Lift carframe, car, counterweight and suspension 11706 : 1986 General requirements of carframe for electric passenger and goods lifts

Section 4 Lift safety gears and governors 9878 : 1981 Safety gears and governors for electric passenger and goods lifts

Section 5 Lift retiring cam 10448 : 1983 Retiring cam for passenger and goods lifts

Section 6 Lift doors and locking devices and contacts 7759 : 1975 Lift door locking devices and contacts; and

11633 : 1986 Lift doors

Section 7 Lift machines and brakes 10913 : 1984 Brakes for electric passenger and goods lifts

Section 8 Lift wire ropes —

Section 9 Controller and operating devices for lifts —

Part 5 Inspection manual —

This edition incorporates Amendments issued to various parts, details of which are indicated in the concerned part as well as in the last cover page. Side bar indicates modification of the text as the result of incorporation of these amendments.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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This Indian Standard has been developed from Doc : No. ETD 25 (5003-5011).

Amendments Issued Since Publication

Part/Sec	Amend No.	Date of Issue
Part 4/Sec 3	Amd. No. 1	November 2002
Part 4/Sec 9	Amd. No. 1	March 2003

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